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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/768,039	02/02/2004	Miho Watanabe	118506	6320

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EXAMINER	
OLSEN, ALLAN W	
ART UNIT	**PAPER NUMBER**
1763	

MAIL DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/768,039	WATANABE ET AL.	
	Examiner	Art Unit	
	Allan Olsen	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 August 2006*.

2a)☒ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-18,22-24,27-46,51 and 53-87* is/are pending in the application.

4a) Of the above claim(s) *1-15,31-39 and 58-87* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *16-18,22-24,27-30,40-46,51 and 53-57* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *02 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Claims 1-15, 32 and 67-87 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to nonelected inventions and claims 31, 33-39 and 58-66 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to nonelected species, there being no allowable generic or linking claim.

Examiner's Notes Regarding Format of the Following Rejections

The following rejections are based upon those of the previous Office action and they are almost identical except for a section added to the end which begins with, "**Regarding the newly added limitation: ...**"

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 16-18, 22-24, 27-30, 40-46, 51 and 53-57 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent Application Publication 2002/0008956 (hereinafter, Niu) in view of WO 200245113 (hereinafter, Ito).

All references to Ito are citations to US Patent Application Publication 2004/0043219, an English language equivalent of WO 200245113.

Niu teaches forming a structure comprising crosslinked carbon nanotubes. See the following excerpts.

[0078] Nanofiber networks may be prepared with or without surface treatment and in various structural forms, i.e. aggregates and mats, as described below. Preferably they are treated to introduce chemical functional groups onto their surfaces. After filtration, washing and drying, the functionalized carbon nanotubes are dispersed in water and then filtered to yield a carbon nanofiber mat. After drying and cross-linking, a rigid carbon nanotube electrode is formed.

[0108] The electrodes may also comprise nanofibers in the form of a rigid porous structure comprising intertwined carbon nanofibers. The rigidity of the nanofibers are improved by causing the nanofibers to form bonds or become glued with other nanofibers at the fiber intersections. The bonding can be induced by chemical modifications of the surface of the nanofibers to promote bonding, by adding "gluing" agents and/or by pyrolyzing the nanofibers to cause fusion
or bonding at the interconnect points.

[0111] Nanofibers may be used in the electrochemical capacitors of the invention in various geometries. They may be present as dispersed fibrils, as aggregates or as mats or films.

[0128] The specific capacitance of nanotube electrodes can be further increased by surface modification. Advantageously, the nanofibers are functionalized nanofibers, i.e. nanofibers whose surfaces are uniformly or non-uniformly modified so as to have a functional chemical moiety associated therewith. The nanofiber surfaces may be functionalized by reaction with oxidizing or other chemical media. The nanofiber surfaces may be uniformly modified either by chemical reaction or by physical adsorption of species which themselves have a chemical reactivity. The nanofiber surfaces may be modified e.g. by oxidation and may be further modified by reaction with other functional groups. The nanofiber surfaces may be modified with a spectrum of functional groups so that the nanofiber can be chemically reacted or physically bonded to chemical groups in a variety of substrates.

[0129] Complex structures of nanofibers may be obtained by linking functional groups on the fibrils with one another by a range of linker chemistries.

[0130] Functionalized nanofibers and methods of making them are set forth in United States patent application Ser. No. 08/352,400 filed on Dec. 8, 1994 for FUNCTIONALIZED NANOTUBES, hereby incorporated by reference.

[0133] The nanofibers are preferably functionalized nanofibers which broadly have the formula

[C.sub.nH.sub.LR.sub.m

[0134] where n is an integer, L is a number less than 0.1 n, m is a number less than 0.5 n,

[0135] each of R is the same and is selected from SO.sub.3H, COOH, NH.sub.2, OH, O, CHO,

[0160] A network of carbon nanofibers are produced by contacting carbon fibrils with an oxidizing agent for a period of time sufficient to oxidize the surface of the carbon nanofibers, contacting the surface-oxidized carbon nanofibers with

reactant suitable for adding a functional group to the surface of the carbon nanofibers, and further contacting the surface-functionalized nanofibers with a cross-linking agent effective for producing a network of carbon nanofibers. A preferred cross-linking agent is a polyol, polyamine or polycarboxylic acid.

[0161] The functionalized nanofibers may also be in the form of rigid networks of nanofibers. A well-dispersed, three-dimensional network of acid-functionalized nanofibers may, for example, be stabilized by cross-linking the acid groups (inter-fibril) with polyols or polyamines to form a rigid network.

[0162] The nanofiber particles also include three-dimensional networks formed by linking functionalized nanofibers of the invention. These complexes include at least two functionalized nanofibers linked by one or more linkers comprising a direct bond or chemical moiety.

It is noted that the limitations of claims 27, 30 and 53-57 are taught in US patent application 08/325,400 (now US Patent 6,203,814), which Niu incorporates by reference in paragraph [0130]. For example, columns 18 and 19 of the '814 patent include the following:

Activation of carboxylic acids for amination with primary amines occurs through the N-hydroxysuccinamyl ester; carbodiimide is used to tie up the water released as a substituted urea. The NHS ester is then converted at RT to the amide by reaction with primary amine.

0.242 g of chlorate-oxidized fibrils (0.62 meq/g) was suspended in 20 ml anhydrous dioxane with stirring in a 100 ml RB flask fitted with a serum stopper. A 20-fold molar excess of N-Hydroxysuccinimide (0.299 g) was added and allowed to dissolve. This was followed by addition of 20-fold molar excess of 1-ethyl-3-(3-dimethylaminopropyl)-carbodiimide (EDAC) (0.510 g), and stirring was continued for 2 hr at RT. At the end of this period stirring was stopped, and the supernatant aspirated and the solids were washed with anhydrous dioxane and MeOH and filtered on a 0.45 micron polysulfone membrane. The solids were washed with additional MeOH on the filter membrane and vacuum-dried until no further weight reduction was observed. Yield of NHS-activated oxidized fibrils was 100% based on the 6% weight gain observed.

Niu does not teach dry etching to pattern the crosslinked carbon nanotubes.

Ito teaches patterning carbon nanotube structures by masking and plasma etching. Ito teaches the mask may comprise a photoresist and/or a hard mask. Ito teaches removing the resist layer. Ito teaches the etching can be carried out by a

variety of methods. Ito explicitly teaches using oxygen radicals as well as ion beam etching. Ito teaches the ion beam etching can take place with or without a mask. See [0111] - [0127].

Ito does not teach using UV irradiation of oxygen to generate oxygen radicals.

The examiner takes Official Notice that UV irradiation of oxygen and the various excitation means taught by Ito are art recognized functionally equivalent methods of generating oxygen radicals.

It would have been obvious to one skilled in the art to pattern the crosslinked carbon nanotube fibrils of Niu by the dry etching methods taught by Ito because Niu teaches the fibrils have high structural stability and teaches forming sheet electrodes but offers little more disclosure pertaining to the structuring of the fibrils. Therefore Ito's dry etching method of patterning crosslinked carbon nanotubes would facilitate Niu's vision that the fibrils can be used as electrodes in various geometries (column 12, lines 38-39) and structures (column 11, lines 29-42).

Regarding the newly added limitation:

The claims now require the formation of a resin resist layer. The examiner notes that Ito teaches the patterning of carbon nanotubes by etching through a metal mask, such as an aluminum mask. Ito teaches the aluminum mask is itself patterned by depositing a resist onto an aluminum layer, then exposing and developing the resist and then etching the exposed aluminum. Ito teaches the carbon nanotubes may be etched before or after removing the resist from the aluminum. As such, Ito teaches using a bilayered mask to pattern the carbon nanotubes.

Ito does not teach that the resist layer, which is deposited on the aluminum and then exposed and developed, is a resin resist. However, by Ito's teaching, the skilled artisan would immediately envisage the resist layer of Ito as being a photoresist. The examiner takes Official Notice that photoresists are typically considered to be resin resists. Therefore, when patterning the carbon nanotubes of Ito, it would have been obvious to one skilled in the art to use a resin resist as part of Ito's bilayered mask.

Claims 16-18, 22-24, 27-30, 40-46, 51 and 53-57 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent Application Publication 2002/0008956 (hereinafter, Niu) in view of WO 200245113 (hereinafter, Ito) and further in view of US Patent Application Publication 2004/0038556 of French et al. (hereinafter, French).

The teachings of Nui and Ito and the rejection as set forth above are herein relied upon.

Regarding the newly added limitation:

The claims now require the formation of a resin resist layer.

The combination of Nui and Ito does not teach using a resin resist.

It would have been obvious to substitute Ito's metal mask with a resin resist layer because French teaches using a resin resist to pattern carbon nanotubes. As such French and Ito demonstrate that a patterned metal layer and a patterned resin resist are functionally equivalent with respect to serving as a masking layer for the dry etching of carbon nanotubes.

Claims 16-18, 22-24, 27-29, 40-46 and 53-56 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent Application Publication 2002/0122765 of Horiuchi et al. (hereinafter, Horiuchi) in view of WO 200245113 (hereinafter, Ito).

All references to Ito are citations to US Patent Application Publication 2004/0043219, an English language equivalent of WO 200245113.

Horiuchi teaches forming a structure comprising crosslinked carbon nanotubes. See, for example, paragraphs [0106] and [0137].

Horiuchi does not teach dry etching to pattern the crosslinked carbon nanotubes.

Ito teaches patterning carbon nanotube structures by masking and plasma etching. Ito teaches the mask may comprise a photoresist and/or a hard mask. Ito teaches removing the resist layer. Ito teaches the etching can be carried out by a variety of methods. Ito explicitly teaches using oxygen radicals as well as ion beam etching. Ito teaches the ion beam etching can take place with or without a mask. See [0111] - [0127].

Ito does not teach using UV irradiation of oxygen to generate oxygen radicals.

The examiner takes Official Notice that UV irradiation of oxygen and the various excitation means taught by Ito are art recognized functionally equivalent methods of generating oxygen radicals.

It would have been obvious to one skilled in the art to pattern the crosslinked carbon nanotubes of Horiuchi by the dry etching methods taught by Ito because Horiuchi generally indicates that dry etching can be used to form holes or channels in the deposited material ([0214]). Horiuchi also teaches that the crosslinked carbon nanotubes can be used in various applications that require structures that are frequently created by dry etching ([0218] - [0221]). As such it would by be obvious to use the

specific teaching of Ito with respect to patterning of crosslinked carbon nanotubes to realize the general teachings of Horiuchi.

Regarding the newly added limitation:

The claims now require the formation of a resin resist layer. The examiner notes that Ito teaches the patterning of carbon nanotubes by etching through a metal mask, such as an aluminum mask. Ito teaches the aluminum mask is itself patterned by depositing a resist onto an aluminum layer, then exposing and developing the resist and then etching the exposed aluminum. Ito teaches the carbon nanotubes may be etched before or after removing the resist from the aluminum. As such, Ito teaches using a bilayered mask to pattern the carbon nanotubes.

Ito does not teach that the resist layer, which is deposited on the aluminum and then exposed and developed, is a resin resist. However, by Ito's teaching, the skilled artisan would immediately envisage the resist layer of Ito as being a photoresist. The examiner takes Official Notice that photoresists are typically considered to be resin resists. Therefore, when patterning the carbon nanotubes of Ito, it would have been obvious to one skilled in the art to use a resin resist as part of Ito's bilayered mask.

Claims 16-18, 22-24, 27-29, 40-46 and 53-56 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent Application Publication 2002/0122765 of Horiuchi et al. (hereinafter, Horiuchi) in view of WO 200245113 (hereinafter, Ito) and further in view of French.

The teachings of Horiuchi and Ito and the rejection as set forth above are herein relied upon.

Regarding the newly added limitation:

The claims now require the formation of a resin resist layer.

The combination of Horiuchi and Ito does not teach using a resin resist.

It would have been obvious to substitute Ito's metal mask with a resin resist layer because French teaches using a resin resist to pattern carbon nanotubes. As such French and Ito demonstrate that a patterned metal layer and a patterned resin resist are functionally equivalent with respect to serving as a masking layer for the dry etching of carbon nanotubes.

Response to Arguments

Applicant's arguments filed February 6, 2007 have been fully considered but they are not persuasive. Applicant's arguments centered on the point that the applied references do not teach the newly claimed limitation of using a resin resist as the masking layer. In the above rejections, the examiner noted Ito use of a bilayered mask the included a resist layer that was exposed and developed. As such, the examiner argued that it was evident that Ito was referring to using photoresists, which are resin resists. Furthermore, new grounds of rejections have been set forth that incorporate a new reference to provide a teaching for the newly claimed resin resist.

Regarding the examiner's reliance on functional equivalency, applicant argues, "that components that are allegedly functionally equivalent are not necessarily obvious in view of one another. See MPEP §2144.06. In this case, for example, the use of

burning in an oxygen ambient as in Ito does not fairly suggest the use of UV irradiation as in claim 23."

The examiner notes that MPEP §2144.06 begins with the following sentence. "In order to rely on equivalence as a rationale supporting an obviousness rejection, the equivalency must be recognized in the prior art". The examiner cites the following documents to provide evidence that the prior art recognizes the equivalency of Ito's plasma source and the claimed UV irradiation as a means of generating oxygen radicals.

US 20060174833 A1

US 20050253131 A1

US 20050170541 A1

US 20050017272 A1

US 20030096472 A1

US 20030008072 A1

US 6710986 B1

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Allan Olsen whose telephone number is 571-272-1441. The examiner can normally be reached on M, W and F: 1-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Allan Olsen
Primary Examiner
Art Unit 1763